



Catalogue No. 88-003-XIE

Innovation Analysis Bulletin

A tri-annual report from Statistics Canada with updates on:

- Government science and technology activities
- Industrial research and development
- Intellectual property commercialization
- Advanced technology and innovation
- Biotechnology
- Connectedness
- Telecommunications and broadcasting
- Electronic commerce

Innovation Analysis Bulletin
Vol. 6, No. 1 (March 2004)

Catalogue Number 88-003-XIE
Aussi disponible en français, N° 88-003-XIF au catalogue

In this issue

The many guises of innovation: What we have learnt and where we are heading (page 3)

For two full days more than 20 theorists, empiricists and policy developers from North America and Europe discussed innovation from different perspectives and sought common understanding of the issues and consensus on where work on the subject should be going in the medium and longer term.

Information and communication technologies: contribution to the economy (page 6)

The recent explosive demand for cell phones, personal computers and internet access has propelled the growth of industries producing ICT (Information and Communication Technologies) goods and services. Unlike manufacturing, the production of ICT services in all provinces exhibited robust growth rates for 1997-2002, providing a major source of growth to the service sector as well as total GDP.

Statistics Canada and the World Summit on the Information Society (page 8)

For five days in December 2003, the city of Geneva, Switzerland was transformed into the largest multicultural information and communication centre in the world: the World Summit on the Information Society (WSIS). Statistics Canada was there.

Digitization of the telecommunications service industry (page 10)

As a crucial component of the ICT sector, the telecommunications services industry has propelled Canada to being one of the world leaders in ICT development and use. The industry's revenues have reached nearly \$33 billion and show profits approaching \$5 billion. The increasing level of connectivity of Canadian households, businesses and governments would not have been possible without upgrades to infrastructure and the launching of new services.

Bioproduct development—an intrinsic part of Canadian biotechnology firms (page 12)

In 2001, bioproduct development was conducted by 133 mostly small private Canadian firms found in several economic sectors.

Canadian firms do experience success in bringing their products onto the commercial market with 62% of the firms at the approval/on market or in production stage.

Firms getting connected: Who's using e-commerce now? (page 14)

Although public sector firms continue to have a higher rate of ICT use than firms in the private sector, since 1999, there has been a rise in ICT use in private sector firms.

Telecommunications service industry improves profits (page 16)

Despite stagnating revenues, the telecommunication services industry improved its profits during the first half of 2003 by controlling operating costs and reducing capital spending. The industry recorded 2.6 billion in profits up a robust 19.4%. A strong financial performance of the wireless segment was achieved in spite of a significant slowdown in the expansion of its customer base.

Cable and satellite television, 2002 (page 17)

The opening of the multi-channel video market to competition in 1997 has had a remarkable impact, in more than one way. For customers, it has meant a choice between at least 3 suppliers, a broader array of video services, and the availability of new services such as interactive program guides and high speed Internet. For the industry, it has meant an expansion of their customer base, a fierce battle between suppliers for those customers, a move to digital technology, and the building and upgrading of networks.

New economy indicators and What's new? (page 18)

Recent and upcoming events in connectedness and innovation analysis.

Book notices (page 21)

Four new books we recommend very highly.



Statistics Canada
Statistique Canada

Canada

Innovation analysis bulletin

ISSN 1488-433X

Please address all enquiries to the Editor, Innovation Analysis Bulletin

E-mail: sieidinfo@statcan.ca

Telephone: (613) 951-8585

Fax: (613) 951-9920

Post: SIEID

Statistics Canada

7th Floor R.H. Coats Building

Tunney's Pasture

Ottawa, Ontario

Canada K1A 0T6

The **Innovation Analysis Bulletin** is an occasional publication of the Science, Innovation and Electronic Information Division of Statistics Canada. It is available, free of charge, on the Statistics Canada Web site (<http://www.statcan.ca>) under **Our Products and Services**, in the area **Free publications**, under the category **Science and Technology**.

The **Innovation Analysis Bulletin** is produced under the direction of Fred Gault and edited by Michael Bordt. Special thanks to the contributors, Rad Joseph and Claire Racine-Label (editing and coordination).

Published by authority of the Minister responsible for Statistics Canada

© Minister of Industry, 2003

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission from Pricing and Licensing Section, Marketing Division, Statistics Canada, Ottawa, Ontario, Canada K1A 0T6.

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner and in the official language of their choice. To this end, the agency has developed standards of service which its employees observe in serving its clients. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1 800 263-1136.

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences – Permanence of Paper for Printed Library Materials, ANSI Z39.48 - 1984.

Downloadable publications

To obtain PDF versions of the papers and questionnaires mentioned in this bulletin, please visit the Statistics Canada Internet site:

Start at the main Statistics Canada page:

<http://www.statcan.ca>

- Our papers are in two areas:

1. Studies

Find studies: Free

Documents are under the categories: Science and Technology and Communications

2. Our products and services

Browse our Internet publications: For sale

Documents are under the category: Science and technology and Communications

- Sample questionnaires are in the section

- Definitions, data sources and methods in the area

- Questionnaires – List by subject under

- Communication and

- Science and technology

Subscription request

If you would like to receive a printed version, or if you would like e-mail notifications of new issues, please contact the editor by e-mail.

Get connected with us

Besides the articles to which we refer in this bulletin, Statistics Canada's Web site provides a wealth of statistics, facts and research papers on a variety of related topics. As well, most of the questionnaires we have used to collect the information are available for research purposes.

As of March, 2004 there were:

- 11 publications for sale
- 12 free publications
- 12 research papers
- 98 working papers, and
- 35 questionnaires.

Symbols

- not available for any reference period
- .. not available for a specific reference period
- ... not applicable
- ^p preliminary
- ^r revised
- x suppressed to meet the confidentiality requirements of the *Statistics Act*
- ^e estimated figures
- ^E use with caution
- F too unreliable to be published

The many guises of innovation: What we have learnt and where we are heading

For two full days more than 20 theorists, empiricists and policy developers from North America and Europe discussed innovation from different perspectives and sought common understanding of the issues and consensus on where work on the subject should be going in the medium and longer term.

The meeting was part of the foresight programme of Science, Innovation and Electronic Information Division at Statistics Canada. Many valuable insights were gained as members of different communities of discourse exchanged their knowledge and arrived at common conclusions. Participants are listed in Table 1.

The research context (Fagerberg)

Work on understanding innovation has been going on for more than 70 years. There have been organized measurement activities for at least 25 years leading to a decade of more formalized measurement, by the Surveys of Innovation in Canada and the European Community Innovation Surveys (CIS). The last decade has also seen the publication of guidelines for measurement and interpretation of innovation data in the *Oslo Manual* (OECD/EuroStat, 1997).

While there is a growing body of knowledge about innovation, there are still questions about definition, common language and the role of management practices. The *Oslo Manual* results from one community (mainly official statisticians) but there are others. An example directly relevant to the workshop was the community associated with the Towards a European Area of Research and Innovation (TEARI) project, led by Jan Fagerberg. The TEARI project aims at a holistic understanding of research and innovation. To communicate that understanding the project has produced the *Oxford Handbook of Innovation* (Fagerberg and Nelson, 2004).

As a result of the efforts of various research communities, there is a body of knowledge about innovation in the firm and the explanatory role of industry, firm size, location, absorptive capacity and strategic management of innovative activities. What is evident is that innovation results from a dynamic interaction among actors, which include firms, universities, government agencies and international institutions. Innovation is a system with feedback loops and stocks and flows of knowledge, as well as energy, materials and human resources. Since relationships between inputs and outputs are non-linear, understanding the impact of innovation requires analysis across space and over time.

The research questions still to be answered include:

- What is the relationship between technological, organizational, and institutional change?
- What is the impact on growth of innovation, imitation and other means of commercialization?
- What are the links between firm organization, knowledge generation, absorption and use and innovation?

Table 1. Participants

Anderson, Frances	Statistics Canada
Baldwin, John	Statistics Canada
Bordt, Michael	Statistics Canada
Boyd, Peter	Industry Canada
Davis, Tim	Statistics Canada
de la Mothe, John	University of Ottawa
Diewert, W. Erwin	University of British Columbia
Ducharme, Louis Marc	Statistics Canada
Earl, Louise	Statistics Canada
Fagerberg, Jan	University of Oslo
Gault, Fred	Statistics Canada
Gertler, Meric S.	University of Toronto
Gera, Sundera	Industry Canada
Gu, Wulong	Statistics Canada
Hamdani, Daood	Statistics Canada
Jankowski, John E.	National Science Foundation, USA
Kremp, Elisabeth	SESSI/ESSI, France
López-Bassols, Vladimir	OECD, France
McDaniel, Susan A.	University of Alberta
Mohnen, Pierre	MERIT, Maastricht University, The Netherlands
Niosi, Jorge	Université du Québec à Montréal
Sharpe, Andrew	Centre for the Study of Living Standards, Canada
St-Jacques, Renée	Industry Canada
Therrien, Pierre	Industry Canada
Verspagen, Bart	University of Technology, Eindhoven, The Netherlands

Answering these questions will require the elaboration of a systems approach to innovation and a common language among the multi-disciplinary communities engaged in research related to innovation.

The policy context (St. Jacques, presentation by Gera)

It is generally accepted in the policy community that technology and innovation are key drivers of productivity and growth. Weaker productivity is responsible for our lower living standards relative to the United States.

Canada has made significant progress in developing from a relatively protected economy to one open to international trade, investments and financial flows—and in the process we have become highly integrated with the U.S. But many indicators point to a more dynamic economy south of the border. Structural change in Canada has not kept pace with the U.S.—and we cannot compete against “low-cost” countries like China and Mexico in standard technology products. In effect, we are being squeezed into a narrow middle ground, with countries like China out-producing us at the lower end and the U.S. outpacing us in leading-edge technologies.

A response of the federal government of Canada is the Innovation Strategy (Government of Canada, 2000a, 2000b, 2000c, 2000d) which recognizes the key role of people, the need to compete globally by producing higher value added products and the importance of communities in the innovation process. A benchmarking report has been commissioned from the Conference Board of Canada. It will establish a baseline of quantifiable indicators to benchmark the innovation performance of Canada against the world.

Some areas where more knowledge was needed were the following:

- determinants of innovation and the link between innovation and productivity;
- the role of commercialization;
- characteristics of small, medium and large firms, both innovators and non-innovators;
- linkages within clusters, and the role of communities in the innovative performance of firms;
- organizational structures and management practices and the link with innovation;
- the role of knowledge workers in innovation, especially in service industries;
- impacts of foreign investment and foreign ownership on innovation; and,
- impacts of mobility of the highly skilled and integration of labour markets on human capital accumulation and innovation.

What do we know now about the effects and correlates of innovation and technological change?

Productivity (Baldwin, Verspagen)

Data from the Canadian 1993 Survey of Innovation, linked to data from other surveys in Statistics Canada, showed that innovation and firm performance were linked. Some findings were that larger firms and research and development (R&D) performers have a higher propensity to innovate.

Verspagen emphasized that R&D was a small part of the solution and stressed the importance of trade. Other possible factors bearing upon productivity include economies of scale that have not yet fully realized in European integration, and the role of institutions.

Developing countries and “catch-up” (Fagerberg)

According to Fagerberg, developing countries that have been most successful at “catching up” have had pro-active governments (Singapore, Taiwan and Korea, for example) and they invested in technical education and R&D infrastructure.

Knowledge management and innovation (Kremp)

Beyond technological change, firms also innovate through organizational change and the adoption of new management practices. The French innovation survey (CIS3), which added four questions on knowledge management (KM) practices, showed that there are positive correlations with innovation and knowledge management intensity. The question was where to go next in linking management practices with innovation.

Space-time and theory (Gertler)

Does space matter? Economic activity in Canada is becoming more, rather than less, spatially concentrated. This raised the question of what theoretical framework was appropriate for capturing spatial characteristics and explaining innovation in the firm and its temporal change. Institutional theory, theories of the firm, of the region, or of clusters, were considered as were other ways of describing change, such as evolutionary dynamics, the use of systems theory and the incorporation of business life cycles.

It was suggested that leadership, or “star” quality, and linkages were important to innovation at the local level. A theory to explain the geography of innovation must incorporate the firm, linkages, framework conditions and path dependence.

Suggestions for exploration (Diewert, Niosi, Sharpe)

Innovation is a social process

How, for example, can lifelong learning be measured and used as an explanatory variable for innovation? The object of interest is no longer only the firm, but also the community and the technology cluster. This requires measurement of human characteristics as well as the links between people and organizations: governments, businesses and universities and colleges.

Innovation is multi-faceted

Current measurements of innovation focus on new products and processes, but what about the diffusion of technologies, practices, and organizational structures in the economy and society and their adoption and adaptation? Understanding the role of diffusion and how it influences the users is important in understanding both economic and social change.

Language to discuss innovation

There is a need for one language if policy instruments, business management and innovation measurement are to manage innovation coherently. Building a common language is a task for the international organizations such as the OECD and UNESCO and the European Union. Much of the relevant language is in the *Oslo Manual*, which is now being revised. There is both a need and an opportunity to influence this process.

The systems approach

“Network alignment” is required when different parts of a system are working towards different and possibly conflicting ends. There are policy implications if systems are to be encouraged to function more coherently in pursuit of an objective such as being more innovative.

Frameworks for indicators

Statistics Canada has used its framework document, *Science and Technology Activities and Impacts: A Framework for a Statistical System* (Statistics Canada, 1998) to guide its measurement work since 1998. The approach of identifying the actors in the system and then measuring the activities, linkages and outcomes has worked well. The application of the framework, however,

should be reviewed to deal with new issues and to incorporate the “social character of innovation” and the “poly-paradigmatic” shifts that are taking place.

The next year in Canada (Anderson, Boyd)

The 1999 Survey of Innovation in manufacturing and selected primary industries contributed to the understanding of innovation and contributed directly to Canada’s Innovation Strategy. By allowing academic researchers to analyze the data, Statistics Canada fostered the establishment of a community of innovation researchers. Many of the researchers contributed to a workshop organized by Industry Canada in November 2001. Papers from the workshop and from the broader innovation community were brought together in *Understanding Innovation in Canadian Industry* (Gault, 2003).

The 2003 Survey of Innovation in selected service industries takes into account much of what was learned in the 1999 survey, especially the need to support sub-provincial statistics. It uses an *Oslo Manual* approach but also included questions on knowledge management practices (which will allow comparison with the work in France with the CIS3) and questions on human resource management practices.

From the Canadian policy perspective, a survey of innovation in service industries is timely. The OECD is considering embarking on a project on Enhancing the Service Economy and the Micro Economic Policy Analysis (MEPA) group of Industry Canada has run a conference on Service Industries in the Knowledge-Based Economy.

As with the development of the survey, the elaboration of the research agenda will be a collaborative effort involving as many of the players as possible.

Tasks for theorists, empiricists and policy developers (all)

Theorists

What appears to be missing is a model that provides a predictive capacity. If there is a model that described a cluster, for example, should it not be possible to populate some of its variables with data from another cluster and infer the values of variables for which data are not available?

Empiricists

The role of the empiricist is to identify and describe the structures that are being examined, to present them to the theorists for explanation and to make them available to the policy developers to guide intervention.

Policy developers

Policy developers need information with which to monitor change and also to benchmark the state of the systems at a particular time so that progress towards targets can be measured. This can be done by involving a broad constituency of industry,

NGOs, and governments in evidence-based policy. Discussion with the statistical office and members of networks, like the ISRN and TEARI, are also crucial.

Conclusion (Davis, Gault)

There was some common understanding of the activity of firm-level innovation and of the factors which affect it. There was also common ground on the outcomes of innovation, such as enhanced productivity, and on the link between firm performance and management practices.

Some of what was learned will contribute to the revision of the *Oslo Manual* and some will be used to improve the measurement and understanding of the activity of innovation in Canada and the use of that information for policy purposes. The question remaining is whether a more substantive contribution to the innovation literature should follow so that this broad community can be maintained.

References

- Fagerberg, Jan and Richard Nelson, eds. (forthcoming in 2004) *Oxford Handbook of Innovation*. Oxford University Press. Oxford.
- Gault, Fred, ed. 2003. *Understanding Innovation in Canadian Industry*. Montreal & Kingston. School of Policy Studies, Queen's University. McGill-Queen's University Press.
- Government of Canada. 2002a. *Achieving Excellence: Investing in People*, Knowledge and Opportunity. Ottawa. Industry Canada.
- Government of Canada. 2002b. *Knowledge Matters: Skills and Learning for Canadians*. Ottawa. Human Resources Development Canada.
- Government of Canada. 2002c. *Canadians Speak on Innovation and Learning*. Ottawa.
- Government of Canada. 2002d. *National Summit on Innovation and Learning: Summary*. Ottawa.
- OECD/Eurostat. 1997. *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. Paris.
- Statistics Canada. 2003. *The Survey of Innovation, Questionnaire*. www.statcan.ca. Ottawa.
- Statistics Canada. 1998. *Science and Technology Activities and Impacts: A Framework for a Statistical Information System*. Catalogue No. 88-522-XPB. Ottawa.
- Statistics Canada. October 24, 2003. "Survey of Earned Doctorates" in *The Daily*. Catalogue No. 11-001XPE. www.statcan.ca. Ottawa.

This article is based on a more detailed working paper: The many guises of innovation: What we have learnt and where we are heading released in The Daily on January 26, 2004.

Louise Earl, SIEID, Statistics Canada.



Information and communication technologies: Contribution to the economy

The recent explosive demand for cell phones, personal computers and internet access has propelled the growth of industries producing ICT (Information and Communication Technologies) goods and services. With Quebec and Ontario accounting for over 85% of ICT manufacturing, the "high-tech meltdown" was damaging, dragging down an otherwise growing manufacturing sector in 2001 and chopping the growth in the 2002 recovery. Unlike manufacturing, the production of ICT services in all provinces exhibited robust growth rates for 1997-2002, providing a major source of growth to the service sector as well as total GDP.

Services lead the new ICT economy

The increased demand for cell phones, personal computers and internet access over the past decade has propelled the growth of industries producing ICT goods and services. Services account for the largest share of the ICT sector (about 80% in 2002) and have expanded steadily over the 1997-2002 period (Table 1). Despite the impact of the "high-tech meltdown", ICT services continued to prosper.

ICT manufacturing production and growth

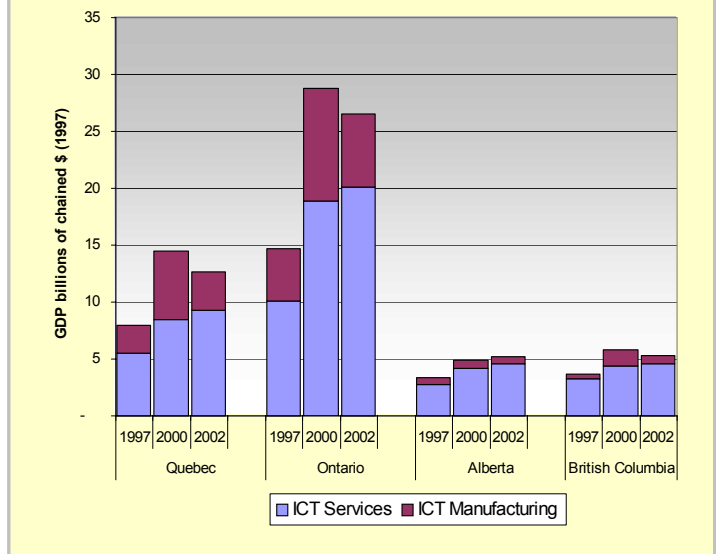
The manufacturing of ICT products is heavily concentrated in central Canada with output mostly exported abroad. These industries produce electrical and electronic equipment including computers, office and business machines, telecommunications equipment, semiconductors and electronic components, broadcasting and other wireless communications equipment, instruments for navigation, measurement medicine and control and communications and energy wire and cable. Years of stellar growth ended abruptly in late 2000 as global demand for investment in ICT infrastructure waned. This had a devastating effect on many ICT manufacturers. The ICT boom and subsequent "Tech-Wreck" in 2001-02 had a significant impact on the economic performance in central Canada vis-à-vis other provinces and territories.

Quebec and Ontario lead the rise and fall

Ontario accounts for more than half of all ICT manufacturing in Canada (Chart 1). Quebec and Ontario combined make up over 85 percent of this industrial sector, while much of the balance is located in British Columbia and Alberta.

The rise and fall of ICT manufacturing was most pronounced in Quebec where output in this sector shot up 136% from 1997-2000 then tumbled to less than half of its 2000 peak by the end of 2002. This had a profound impact on Quebec's manufacturing sector. In 1998 and 1999 ICT industries contributed approximately 40% of overall manufacturing growth. The effect of the "high-tech meltdown" was devastating, dragging down an otherwise growing manufacturing sector in 2001 and chopping half the growth in the 2002 recovery. Producers of telecommunications equipment represent the dominant ICT industry, expanding nearly two and half times in Quebec from 1997-2000. In the subsequent two years, however, output fell 41% in 2001 and a further 33% in 2002.

Chart 1. GDP billions of chained \$ (1997)



In Ontario the effects of the high-tech meltdown on the ICT manufacturing were somewhat less dramatic, but the gains and pains were severe for selected industries. From 1997-2000 the GDP of ICT manufacturing industries shot up almost 120%, led by producers of semiconductors and electronic equipment where output expanded threefold. During the slide in 2001-02, the effects were hardest felt by producers of telecommunications equipment where the value of output in 2002 was a mere 17% of its 2000 peak. This had a rippling effect on fabricators of electronic components. With the exception of communications and energy wire and cable, other ICT industries fared relatively well over this period.

ICT Manufacturing in British Columbia is concentrated in the production of semiconductors and electronic components and computers and peripherals. These two industries were responsible for more than tripling the output of this sector between 1997 and 2000. By the end of 2002, output was less than half of the 2000 peak. Telephone apparatus is the dominant ICT industry in Alberta. With the exception of a 19% slide in 2001, output of ICT manufacturing was relatively stable compared to central Canada.

Even though ICT manufacturing is concentrated in Canada's four largest provinces, there are important pockets of specialization in the smaller provinces, for example, navigational instruments in the Atlantic Provinces, communications and energy wire and cable in Saskatchewan and Manitoba.

Steady growth in ICT services and Internet use

ICT services, unlike manufacturing, continued to expand at a brisk pace over the entire 1997-2002 period. The production of ICT services, with few exceptions, is consumed within Canada. There is a modest amount of inter-provincial trade from larger to smaller provinces and the territories. The growing demand for ICT services has been particularly strong in the household sector where purchases of personal computers, cell phones and other electronic devices (mostly imported) have greatly increased domestic demand for ICT services such as telecommunications and cable internet access. The expansion of wireless communications has facilitated access to internet and television and other communications services to remote regions of the country. Canada boasts one of the highest rates of household internet access. The proportion of households using internet regularly reached 60% in 2001 - nearly doubling since 1997. In 2002, 7.5 million households had at least one member who used the internet regularly at home, work, school or library. Among OECD countries Canada is second only to Korea for per capita broadband connectedness. Broadband (high speed internet access) has emerged as the standard for business and government. In 2001, about half of all households using Internet at home (2.8 million), subscribed using broadband. It is of no surprise that household purchases of personal computers and related equipment have soared, more than doubling in every province from 1997-2001, before easing back modestly in 2002.

Distribution of services by province

Provincial distribution of ICT services production closely resembles the distribution of the Canadian population as telecommunication, cable TV distribution and computer-related services are largely provincially based (Table 1). Consumer demand for telecommunications services in Canada surged 57% from 1997-2002 led by Ontario and Alberta with growth of 75% and 57% respectively. Over the same period, personal spending on cable and pay TV jumped by almost one-third with particularly strong expansion in Alberta, Manitoba and Ontario. For almost all years (1997-2002) in all provinces, the production of ICT services exhibited robust growth rates providing a major source of growth to the service sector as well as total GDP. In most provinces there was a sharp increase in computer systems design services in 1999 reflecting concerns and needs to redesign for Y2K compliance.

Current trends and potential renewed activity

Demand for ICT services are continuing to expand within the household, business and public sectors, but are showing some sign of abatement as growth of household internet use has levelled off. New technologies and the continued transition to digital information and communications are showing some sporadic signs of renewed activity.

This article was originally released in the Daily on November 6, 2003.

Hans Messinger, Director, Industry Measure and Analysis Division, Statistics Canada.



Table 1. Gross Domestic Product of ICT Sector (GDP millions of chained \$ (1997))

		1997	1998	1999	2000	2001	2002
Newfoundland	Goods	3.6	6.3	10.3	17.7	9.5	10.4
	Services	296.2	339.7	350.7	400.9	437.3	477.4
Prince Edward Island	Goods	1.6	2.3	0.6	2.0	2.4	1.9
	Services	62.9	71.3	81.2	87.5	89.2	97.3
Nova Scotia	Goods	36.7	54.5	59.1	73.4	80.1	81.1
	Services	562.6	635.9	718.8	753.5	825.2	904.8
New Brunswick	Goods	13.8	12.4	19.2	28.8	21.0	20.0
	Services	481.9	550.7	610.6	638.4	698.0	763.4
Quebec	Goods	2,473.3	3,145.5	4,949.8	5,827.0	4,371.1	3,391.4
	Services	5,532.9	6,340.2	7,386.8	7,905.3	8,581.1	9,260.6
Ontario	Goods	4,535.4	5,260.4	6,872.1	9,799.1	7,172.3	6,487.8
	Services	10,119.6	11,570.1	15,395.9	17,399.7	19,005.2	20,073.4
Manitoba	Goods	88.3	89.2	95.8	144.4	112.9	86.0
	Services	660.2	758.5	815.0	885.7	965.8	1,032.0
Saskatchewan	Goods	82.5	89.1	202.3	278.7	205.9	135.9
	Services	638.1	704.0	788.6	817.6	828.7	860.1
Alberta	Goods	560.9	616.9	689.6	650.9	524.8	524.4
	Services	2,772.9	3,318.6	3,560.2	3,936.9	4,337.9	4,635.3
British Columbia	Goods	433.2	509.5	777.2	1,371.1	950.2	681.5
	Services	3,252.2	3,575.3	3,913.4	4,075.4	4,426.1	4,620.9
Yukon	Goods	0.0	0.0	0.0	0.0	0.0	0.1
	Services	22.5	32.8	33.3	39.8	38.4	39.9
NWT	Goods	0.0	0.0	0.0	0.0	0.0	0.0
	Services	74.8	60.5	53.3	54.3	61.3	67.7
Nunavut	Goods	0.0	0.0	0.0	0.0	0.0	0.0
	Services	0.1	0.1	15.0	18.6	21.3	23.6
Canada	Goods	8,229.2	9,786.2	13,676.0	18,192.9	13,450.3	11,420.4
	Services	24,476.7	27,957.6	33,722.7	37,013.6	40,315.3	42,856.3

Source: Statistics Canada.

Statistics Canada and the World Summit on the Information Society

For five days in December 2003, the city of Geneva, Switzerland was transformed into the largest multicultural information and communication centre in the world. More than 11,000 gathered for the gamut of meetings, workshops, discussions and exhibitions, all of them culminating at a global summit on the topic of the Information Society. Why all the fuss? Information in this age of technology moves faster than it can be processed. We are now living in what many have termed an 'Information Society', where information and communications technologies (ICTs)—most notably the Internet—have transformed the way in which we live, learn and work.

Statistics Canada has been actively monitoring the information society in its surveys and analyses. The agency was represented at two high-profile events in Geneva that brought together leading organizations and individuals from developed and developing countries to share experiences related to the Information Society. Statistics Canada provided valuable contributions to the various workshops and exhibits, and took the opportunity to showcase its work in the area of the Information Society, as well as to release the compendium publication entitled *Canada's Journey to an Information Society*.

Monitoring the Information Society

The first event was the statistical workshop entitled Monitoring the Information Society: Data, Measurement and Methods. Held on December 8-9, 2003, it was jointly organized by several United Nations (UN) organizations (the UN Economic Commission for Europe, the UN Conference on Trade and Development, the International Telecommunication Union and the UNESCO Institute for Statistics), as well as the Organization for Economic Cooperation and Development (OECD) and the Statistical Office of the European Communities (EuroStat). Its purpose was to bring representatives from national statistical offices, policy makers and ICT analysts together to take stock of existing statistical systems in the area of the Information Society and deal with information gaps that impede progress in this area. By examining a variety of ICT-related themes, the workshop aimed at identifying critical, measurable indicators that currently do not exist, as well as to find ways to encourage countries that do not currently collect the relevant data to do so within their official statistics programmes.

The workshop was a precursor to the World Summit on the Information Society (WSIS), which immediately followed. In view of the Summit's Declaration of Principles and Plan of Action, there is a need to monitor the progress made towards the goals at a second Summit (Tunis, 2005) and beyond. Many voices from all walks of life are now assigning a very high priority to Information Society measurements and stress the need to identify and close existing global ICT data gaps through the realm of official statistics.

Statistics Canada's measurement and analysis of e-commerce

Tim Davis, Director General of Statistics Canada's Agriculture, Technology and Transportation Statistics Branch, addressed a session on statistical measurements of electronic business. His overview of the measurement and analysis of e-commerce in Canada focused largely on Statistics Canada's survey programs in this area, including data and findings from the Survey of Electronic Commerce and Technology (SECT). Mr. Davis also emphasized the importance of coordination and analysis activities to "link data collection with policy" and ensure program relevance.

Role of ICTs in economic and societal transformations

Fred Gault, Director of Statistics Canada's Science, Innovation and Electronic Information Division (SIEID), was the discussant for a session on the role of ICTs in economic and societal transformations. In his opening remarks, Mr. Gault noted that the Information Society is not new; what is new over the last decade is the electronic activity on the Internet. "However the Information Society is maturing", he continued, "and we must advance beyond statistics of readiness to understand the intensity of use and the impact of ICT on the economy and society."

ICT penetration and the digital divide

George Sciadas, Chief, Information Society Research and Analysis (SIEID, Statistics Canada), was one of the organizers, as well as a discussant for the session on ICT penetration and the digital divide. Mr. Sciadas reminded participants that statistics can only be collected and analyzed if there is a demand for them. He also stressed the importance of developing a minimum set of core indicators for international comparison, and he invited the developing world to learn from the mistakes that developed countries have made along the way. His work on the Digital Divide continues to encourage international cooperation and standards in the measurement and analysis of information society indicators.

Official statistics play a critical role

Conclusions and recommendations from the workshop explicitly address what has been done to date, how it was done and how to proceed in the future. It was agreed by all that official statistics

have a critical role to play in shaping the Information Society and that there is a need for international benchmarking and a core set of international indicators. But as Mr. Gault points out, “The real question now is whether the UN community will engage in the statistical discussion and bring a substantive plan of action to the next meeting of the WSIS in Tunis, 2005.”

An Information Society for all

Organized by the United Nations system, the first phase of WSIS was held in Geneva, December 9-13, 2003, with phase two slated for Tunis, 2005. The Summit provided a unique opportunity for key stakeholders to develop a better understanding of the information revolution and its impact on the international community. More than 11,000 delegates from government, the private sector and civil society attended the Geneva phase—including approximately 50 Heads of state—with a common goal to develop and foster a clear Declaration of Principles and a concrete Plan of Action to bring the benefits of ICT for social and economic development to people in all parts of the world.

Integral to bridging the digital divide is respect for the universal human values of equality, justice, democracy, freedom of expression, mutual tolerance and respect for diversity. It is for these reasons that UN Secretary-General Kofi Annan endorsed the Summit as a means to meet the Millennium Development Goals (MDGs) of combating poverty, hunger, illiteracy, disease and environmental degradation, and to create a more peaceful and prosperous world.

Canadian participation at WSIS

Other events paralleling WSIS included Summit forums, the World Bank’s *infoDev* symposium, award events and the ICT for Development (ICT4D) Platform, which included over two hundred government, business and NGO exhibits. The Canadian Pavilion showcased the work and achievements of several government departments. Statistics Canada was among them as was the Canadian e-Policy Resource Centre, Industry Canada, the International Development Research Centre, the Canadian International Development Agency, Communications Research Canada and the Department of Canadian Heritage. The Canadian Delegation worked effectively to highlight Canada’s ICT success stories in e-development, e-trade, e-learning, e-culture and

e-government. Strong interest was shown by many African countries and media.

As Head of Canada’s Delegation, Ambassador Sergio Marchi (Canadian Ambassador to the Office of the United Nations in Geneva and the World Trade Organization) delivered Canada’s plenary statement, touching on many of the Summit themes—human rights, Africa, ICTs and development through partnerships—and generated considerable interest. In particular, the President of Senegal cited Canada as a model of a connected country and for exemplary cooperation. The Summit was an excellent opportunity for Canada to

advance global and regional initiatives and to promote national success stories. As Chair of the UN ICT Task Force working group charged with demonstrating how ICTs can help achieve the MDGs, the Canadian Delegation presented the results of this work in various forums. This initiative will be used to coordinate the statistical work currently being

carried out by various international organizations and will be supported by the international community in identifying specific ICT indicators which would relate to the MDGs.

“[The Summit] offers a forum to develop a shared vision of an information society that empowers and benefits all people. And it can help us to make specific connections between information and communications technologies and the Millennium Development Goals set by the international community, since without creative and widespread use of those technologies, the goals will be that much harder to meet.”

*- Kofi Annan,
Secretary-General of the United Nations*

Canadian influence

The Summit Declaration of Principles and Plan of Action were unanimously adopted by all countries at WSIS. These provide the common vision and guiding principles, as well as the concrete actions to be taken in order to advance the achievement of the internationally-agreed development goals. Much work remains to be done between now and Tunis, 2005, but the first phase of WSIS has given everyone a good start. Canada is well-placed to influence the process and outcomes.

For more information on WSIS, visit <http://www.itu.int/wsis>.

Canada's journey to an information society, 1997 to 2002 (56-508-XIE, free) was released on December 9, 2003 in the Statistics Canada Daily. From the [Our products and services](#) page, under [Browse our Internet publications](#), choose [Free](#), then [Communications](#).

Orbicom's [Monitoring the Digital Divide](#) is available for free from <http://www.orbicom.uqam.ca>.

Heidi Ertl, SIEID, Statistics Canada



Digitisation of the telecommunications services industry

Canadians have helped develop the most advanced communications technologies in the world and they are intensive users of those technologies. The telecommunications services industry has propelled Canada into world leadership in ICT development and use. The increasing connectivity of Canadian households, businesses and governments would not have been possible without the upgrades to infrastructure and the new services launched by this industry.

Overview of the telecommunications services industry

Recent years have seen an evolution of the telecommunications services industry brought about by regulatory, technological and market changes. Many of these changes have taken place in the wireless sector, which has experienced double-digit growth in subscribers and profits. Meanwhile, the relatively flat growth of operating profits and access paths of the wireline sector are characteristic of a more mature industry. The rapid transformation of global communications has led to impressive growth, on most fronts, in telecommunications services.

Wireline Access

Digital service is the transmission of binary digital signals, a continuous string of zeros and ones. In telecommunications it is the transmission of digitally encoded analogue signals in the wireline or wireless networks.

Digitisation is the movement from an analogue to a digital telecommunications network. In the wireline telecommunications industry this refers to the connection of public switched telephone network (PSTN) lines to digital switches. In the wireless industry it refers to an increase in the number of digital cells and subscribers.

The number of voice grade equivalent (VGE) access paths to the Public Switched Telephone Network (PSTN) exceeded one per person for the first time in 2001 and has continued to rise. However, there are still locations in Canada where one telephone line is shared by more than one household. At the other extreme, there are many Canadians who can be reached at more than one telephone number, for example their home, office and mobile. In addition to an increase in the number of telephone connections, there has been an increase in the quality and capacity of the telecommunications networks. Crucial among these improvements has been the movement to a digital network, which allows the provision of database services such as Caller-ID.

Wireless telecommunications continues to grow

In 1987¹, cellular subscribers represented less than 1% of the population. In the intervening 15 years, this has increased to over 37% of the population (fourth quarter of 2002). In 2001, total mobile subscribers increased by 22%. However, this increase was attributable to digital subscrib-

ers, which increased by 69%. The number of analogue subscribers actually declined—by close to 27%. Taken together, these resulted in more than 70% of all mobile subscribers being digital, an increase of about 39% over 2000. Examination of more recent data confirms that this trend is continuing. For example in the fourth quarter of 2002 digital subscribers were up 28.7% over Q4 2001, and analogue subscribers were down 25.7% over the same period. (Table 1).

Digitisation

The introduction of digital switches and other software have allowed more information to be carried along with the voice signal. For example, we can now see who is calling; we can be notified if there is another caller while we are talking and we can reject calls from specific callers. These services have almost become synonymous with basic telephone service.

In addition to the consumer benefits, telecommunications carriers had technical and financial reasons for switching to digital signals. Some of these include the ability to send multiple conversations over a single facility, send voice and data together and improvement in sound quality.

The digitisation of the wired network appears to have reached a stationary level in 2001, with 99.8% of all PSTN lines being digital. It also appears that carriers are replacing their analogue lines with digital as the overall growth in total PSTN lines (1.4%) is roughly equal to the growth in digital PSTN lines (1.5%). The residential market accounts for more than two-thirds of the remaining analogue lines.

Demand for mobile telephony has increased because of reduced costs, increased services, better quality and improved coverage. Some of these changes can be attributed to the investment and rollout of a digital infrastructure. For example, a digital wireless

The statistics presented in this article are from the Quarterly and Annual Surveys of Telecommunications, covering establishments primarily engaged in the transmission of voice, data, text, image and video. The annual survey is a census of all telecommunications services providers. It captures all telecommunications activity under NAICS 5133. The quarterly survey includes the largest establishments—major wireline carriers and the wireless industry – with under-coverage estimates based on the annual survey for those units that make up the industry but are not included in the quarterly (resellers, satellite and small wireline and wireless service providers).

¹ Prior to 1987 all data collected on the wireless communication system or cellular phone system was suppressed to meet the confidentiality requirements of the Statistics Act.

Table 1. Connectedness Indicators

	Units	1998	1999	2000	2001	2002
VGE Access paths:						
Wireline access to the PSTN (VGE)	thousands	19,294	19,806	20,347	20,805	20,205
Mobile access to the PSTN (VGE)	thousands	5,346	6,911	8,727	10,649	11,861
Access to the PSTN - Total (VGE)	thousands	24,640	26,717	29,074	31,454	32,066
Wireline access (VGE) to the PSTN	per 100 population	63.8	64.9	66.1	66.9	64.2
Mobile access to the PSTN	per 100 population	17.7	22.7	28.3	34.2	37.7
Total PSTN (VGE) access	per 100 population	81.5	87.6	94.4	101.1	101.8
PSTN Digitalization:						
Access lines -						
Connected to digital switches	thousands	18,679	19,105	19,478	19,761	..
Connected to analogue switches	thousands	92	82	49	49	..
Total PSTN lines	thousands	18,771	19,187	19,527	19,810	..
Digital lines as a % of PSTN lines	thousands	99.5	99.6	99.7	99.8	..
Mobile Access paths:						
Digital	thousands	1,407	2,593	4,444	7,510	8,948
Analogue	thousands	3,939	4,318	4,283	3,139	2,913
Total mobile access	thousands	5,346	6,911	8,727	10,649	11,861
Digital access paths as % of PSTN mobile access						
Total digital access to the PSTN	thousands	20,086	21,698	23,922	27,271	..
Total analogue access to the PSTN	thousands	4,031	4,400	4,332	3,188	..
Total PSTN access	thousands	24,117	26,098	28,254	30,459	..
Total % digital access	percent	83.3	83.1	84.7	89.5	..

Source: Annual, Quarterly Surveys of Telecommunications, Science, Innovation and Electronic Information Division, Statistics Canada.

system allows more subscribers to use a given cell at the same time, reducing the cost of servicing a new subscriber. The digital system also allows more information to be carried with the conversation, enabling more services. Improvements in quality can be directly attributable to the very nature of the digital signal.

Not only has growth in wireless subscribers been exponential, but the capabilities of the cellular network have also expanded from voice-only communication to electronic messaging and web browsing. In addition to the improvements in technology, there has been an increase in the number of cells. In other words, not only can you use your mobile phone to surf the Internet, but also to surf in many new locations.

Looking to the future

For the wireless sector - manufacturers, governments and international standard bodies have stated that they will move towards a 3rd generation system that allows faster downloads as well as better integration among the various existing technologies. Combined with the apparent need for speed and capabilities by existing and future users, this rollout of new technologies seems to be a certainty.

A possible detour would be the leap to 3.5 or even 4th generation wireless by those companies that want to be first out of the gate. However, while this advancement would reduce or even eliminate the compatibility of all existing systems, it would allow for

the introduction of even more advanced capabilities sooner. For example, two-way synchronous wireless video calls allowing you to not only call your friends from the ski-lift, but also show them the view.

While advancements in wireline services have occurred over the last few years, the basic product has not changed as dramatically as the wireless system. In addition to the competition provided by the wireless system for both new and existing customers, the wireline industry is facing competition from the cable industry. Cable operators have already rolled-out telecommunications service in Atlantic Canada.

However, wireline providers still have a number of advantages. First among these is a physical connection to most, if not all, Canadian homes and businesses. This, combined with their potentially unlimited bandwidth, suggests that some of the more advanced smart-home capabilities may only be available to wired homes.

This article was previously published in *Canada's journey to an information society, 1997 to 2002* (56-508-XIE, free) released in the *Statistics Canada Daily* on December 9, 2003.

Cimeron McDonald, SIEID, Statistics Canada



Bioproduct development—an intrinsic part of Canadian biotechnology firms

Data from the 2001 *Biotechnology Use and Development Survey* reveal that there are 133 biotechnology Canadian-based firms manufacturing or developing bioproducts. These mostly private “home-grown” firms located in Quebec, British Columbia and Ontario are operating across all economic sectors. The largest share of their combined portfolio of 805 bioproducts is at the commercialization stage. Bioprocessing-based bioproducts (products developed or made using enzymes and bacteria culture) lead the way.

Defining bioproducts

In this paper and in the 2001 Biotechnology Use and Development Survey (BUDS), a bioproduct is defined as “a commercial or industrial product (other than food and feed) made with biological or renewable domestic agricultural (plant, animal), marine or forestry materials, such as bio-energy (heating and electricity), bio-fuels (ethanol and biodiesel), bio-chemicals, fiberboard, textiles and bio-plastic, other”.

Characteristics of bioproduct firms

Small privately owned “home-grown” biotech firms led the way in 2001 with bioproduct development principally in the hands of small and young private Canadian firms, over a third of which were spun-off from various sources. Ninety two (92) of the 133 bioproduct firms were found to be small firms with fewer than 50 employees, including 25 that are publicly traded (Chart 1). Although 35% are spin-off companies, only 6% of the firms were subsidiaries of multinational firms. Bioproduct firms are generally young—averaging 17 years of age.

Bioproduct types and firms producing them

Bioprocessing-based bioproducts involved 37% of firms (49 out of 133 companies, see Chart 2). Water cleaning and decontamination using biofiltration, bioremediation and phytoremediation involved the second largest number of firms (45). Bioproducts from non-food agriculture (as it relates to the manufacturing and development of fuels, lubricants, commodity and fine chemical feedstock, and cosmetics) ranked second with 28 firms. Aquaculture and bioproducts for air cleaning and decontamination are also important areas for bioproduct development with 23 and 21 firms, respectively. Other fields include soil cleaning and decontamination products (16 firms), forest based bioproducts (12 firms) and bioproducts for energy production and mining (9 firms).

There were 352 bioprocessing-based bioproducts, making this sector the largest, both in terms of the number of firms participating and the number of products. At the other end of the spectrum, there were far fewer bioproducts made or developed for mining and energy production using microbiologically enhanced recovery methods, industrial bioprocessing and biodesulpharization—only 12 products.

The development of bioprocessing-based bioproducts, water cleaning and decontamination, and non-food agricultural production based bioproducts involved most firms. However, the latter two

Chart 1: Characteristics of bioproduct firms

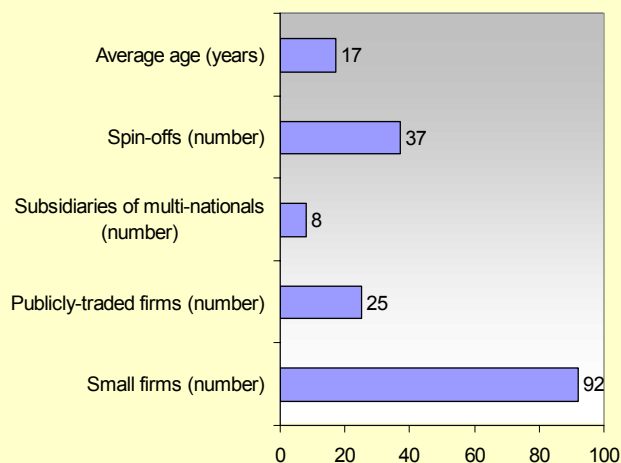


Chart 2: Types of bioproducts and number of firms involved in producing them

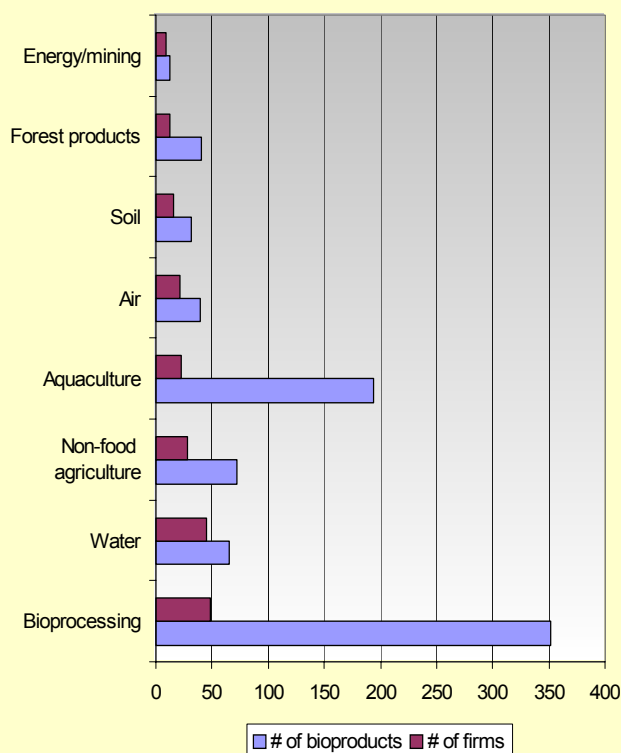


Chart 3: Sectors involved in developing bioproducts

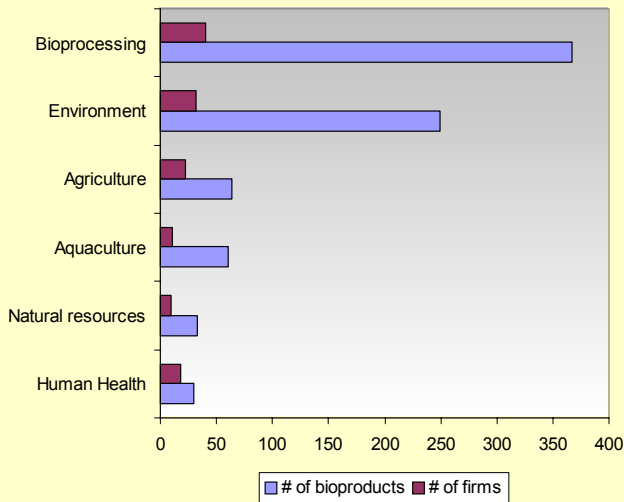
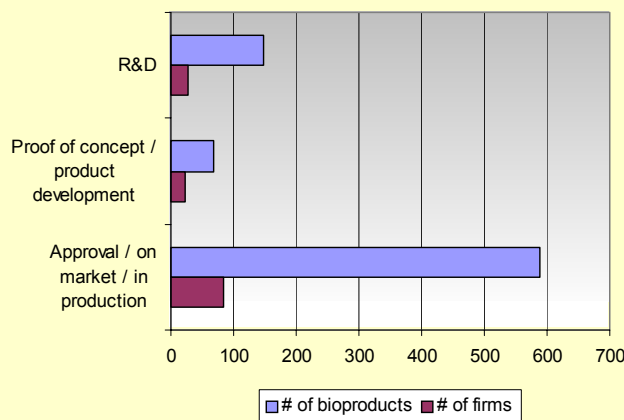


Chart 4: Distribution of bioproduct firms and bioproducts by stage of development



sectors with respectively 65 and 72 bioproducts were outpaced by aquaculture in terms of the number of products at 194.

Sectors involved in developing bioproducts

Bioproduct firms are found in several economic sectors. More than any other sector, bioprocessing and the environment sectors accounted for the largest number of firms, 40 and 32, respectively. Together, these two sectors had 53% of all the 133 bioproduct firms in 2001. These were also the sectors where the largest number of bioproducts were developed, 367 for bioprocessing and 249 for the environment sector, agriculture followed with 22 firms and 64 products, human health with 18 firms and 30 products, aquaculture with 11 firms and 61 products, and natural resources with 10 firms and 33 products.

The difference between figures in Chart 2 and Chart 3 indicates that development of bioproducts for a given sector is not limited to firms in that sector. For example, from Chart 3, there were

only 11 firms in aquaculture developing 61 products, far fewer than the 194 aquacultural bioproducts developed by 23 firms as illustrated in Chart 2. This implies that there were non-aquaculture firms developing or making bioproducts intended for use in aquaculture. This holds true for the other sectors as well.

Distribution of bioproduct firms and bioproducts by stage of development

Bioproduct firms do experience success in bringing their products onto the market. Generally, not only are they successful in climbing the ladder of products development, but they also bring a large number of their products to the commercialization and approval/production stage. Sixty-two percent (83 of 133 firms) are at the approval/on market/in production stage. Twenty-seven companies (20%) are at the R&D stage, and 17% (23 firms) have products at the proof/product development stage.

As Chart 4 also illustrates, 588 of the 805 bioproducts are either approved, on the market or in production. Comparatively, 148 are the R&D stage and 69 at the proof of concept/product development stage.

Limits of the study

Data used in this study are from a survey designed to capture biotechnology activities in Canada in 2001. The 133 firms in this study are firms that use biotechnologies to develop or make products/processes. This excludes firms that use other bioproduct development techniques. Thus, these 133 firms underestimate the actual number of Canadian bioproduct firms. Other relevant questions that could not be answered in this study due to data limitation include the number of employees dedicated to bioproduct development, the share of revenues coming from the sales of bioproducts, the share of total R&D expenditures dedicated to bioproduct research and development. Consequently, data collected and presented in this paper provide a partial picture of bioproduct development in Canada. This study shows that there are firms engaged in the production of bioproducts and the characteristics of these firms are provided.

References

Agriculture and Agri-Food Canada. 2003. *Federal-Provincial-Territorial Framework Agreement on Agricultural and Agri-food Policy for the Twenty-first Century; Part two: Chapter Components of the Framework Agreement*, Section E, Science and Innovation ; Definitions 32.1, Ottawa, Canada.
 Contact Canada. 2001. *Diagnostics Canada: B2B Industry Guide 2001*. Georgetown, Ontario.

Contact Canada. 2001. *Pharma, BioPharma & Nutraceuticals, Canada: Industry B2B Guide*, Georgetown, Ontario.

Contact Canada. 2002. *Canadian Biotechnology: Industry and Supplier B2B Guide 200*, Georgetown, Ontario.

McNiven, Chuck, Lara Raoub and Namatié Traoré. 2003. *Features of Canadian biotechnology innovative firms: Results from the biotechnology use and development survey – 2001*. Statistics Canada, Science, Innovation and Electronic Information Division working papers, Cat. No. 88F0006XIE2003005.

Statistics Canada. 2001. *Biotechnology Use and Development Survey – 2001, phase 1*, Science, Innovation and Electronic Information Division; 5-4900-505: 2001-01-24; SQC/SAT-465-75330.

Statistics Canada. 2001. *Biotechnology Use and Development Survey–2001, phase 2*, Science, Innovation and Electronic In-

formation Division, SIEID; 5-5300-500.2: 2002-02-06; SQC/SAT-430-75177.

Traoré, Namatié. 2003. *Biotechnology Use and Development Survey: Methodology, Issues and Answers*. Statistics Canada, Science, Innovation and Electronic Information Division, SIEID, in Press.

This article is based on a paper entitled Bioproducts development by Canadian biotechnology firms: findings from the 2001 Biotechnology Use and Development Survey, Cat. No. 88F0006XIE2003013, released in the Statistics Canada Daily on December 8, 2003. Please see page 2 for instructions on downloading our working papers.

Namatié Traoré, SIEID, Statistics Canada.



Firms getting connected: Who's using e-commerce now?

Statistics Canada's 2002 *Survey of Electronic Commerce and Technology* revealed that an increasing percentage of firms continue to adopt and use e-commerce and Information and Communication Technologies (ICTs). Firms in the service industry are more likely to adopt e-commerce and ICTs than those in primary or secondary industries. In addition, as a whole, public sector firms continue to have a higher rate of ICT use than firms in the private sector.

Basic ICT use: growth throughout the private sector

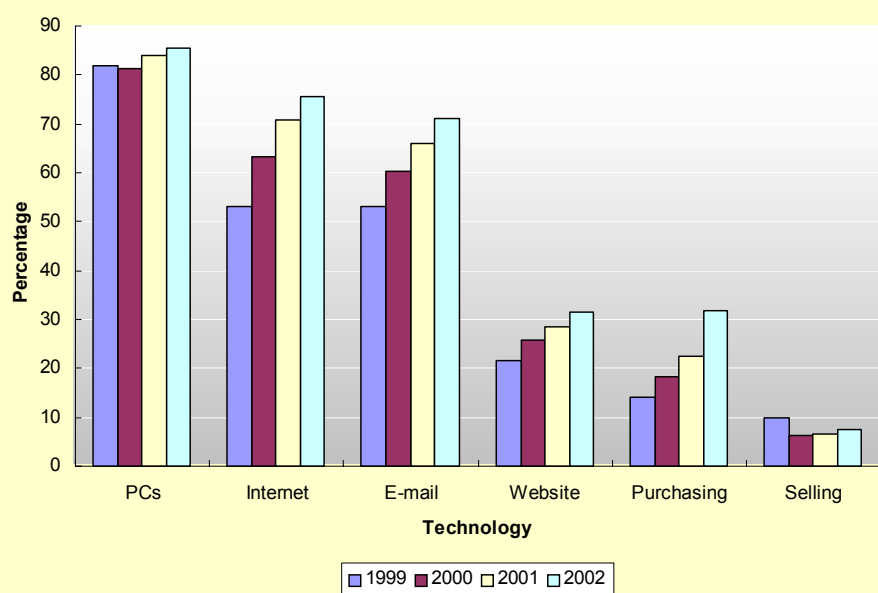
The *Survey of Electronic Commerce and Technology* (SECT) measures firms' usage of three basic technologies: PCs, e-mail and Internet. While both private and public firms continue to increase their use of ICTs, saturation of the technology is much more pronounced in the public sector. PCs, Internet and E-mail have become a staple at public institutions in Canada; now being used by nearly 100% of public-sector enterprises.

Since 1999, there has been a rise in the percentage of private sector firms that use all three technologies (see Figure 1). As PC use has become widespread throughout private firms, the rate of growth has been much higher for Internet and e-mail use during this period. The percentage of private firms that use e-mail has grown from 53% in 1999 to 71% in 2002. Private firms' Internet use has increased from 53% in 1999 to 75% in 2002.

The firms that tend to embrace ICTs are those that are able to adjust their sales

model to incorporate the technology. The information and culture industries, in particular, are intensive users of basic ICTs as the Internet provides a cost-effective way to deliver information to a large audience. This industry has been a leader of basic ICT use throughout the past four years.

Figure 1. Percentage of firms using selected technologies (1999-2002)



Broadband use is expanding

Increased use of broadband, and the added speed on the Internet it brings, has made ICTs much more popular and easier for enterprises to use. Broadband technology acts as an enabler for more complex ICTs such as websites, intranets and extranets. In addition, high-speed Internet is no longer as costly or technically challenging for an enterprise to implement.

The move towards high-speed Internet has been quite noticeable across the private sector between 2000 and 2002. Overall, 58% of enterprises used a high-speed channel to access the Internet in 2002, compared to 35% in 2000. Government programs designed to increase access to broadband, primarily in rural areas, may be responsible for part of this growth and may allow for continued growth in this area. In 2002, 93% of public enterprises used broadband, establishing them as leaders of the technology.

Websites continue to increase as do features

The use of websites by all types of enterprises is becoming more prevalent. While many of these websites now are operating largely as a source of information, it is expected that they will also continue to become more transactional. This is a general trend of the transformation toward e-business as enterprises are able to use their technology in a more functional manner. In 1999, 21.7% of enterprises had their own website. By 2002, this had increased by ten percentage points for the private sector as a whole (31.5%). The percentage of firms offering a company website increased in every industrial sector between 2000 and 2002.

While the sheer number of websites continues to rise, so does the number of features that a website can offer due to new technology. Updated websites may now offer such advanced features as wireless access, interactivity, information about employment and online payment for products. However, the majority of websites are still presented on the Internet largely as an outlet to display information about the business' products and services.

Proportion of firms selling online continues to rise

In the private sector, the proportion of enterprises that purchase online, with or without online payment, has increased. Two principal reasons for firms to purchase online are cost reduction and access to a greater selection of products. The proportion of enterprises in the private sector that purchased online was 14% in 1999 and has increased to 32% in 2002. Related technologies such as increased broadband use are making online buying more accessible for all types of firms.

In 1999, 10% of firms were selling their products online. In 2000, this number had fallen to 6.4%, but rose slightly to settle at 7.5% in 2002. Though the proportion of private firms engaged in selling online experienced an overall decline, the value of sales online increased between 1999 and 2002. Overall sales have grown from \$4.2B in 1999 to \$13.3B in 2002. The majority of the value of sales (72%) are still made from business to business (B2B) but this has fallen from 80% in 2000, demonstrating the increasing role that individuals play in e-commerce.

In 2002, 14.2% of public firms sold online compared to 7.5% of private firms. However, the value of Internet sales by the private sector continued to be much higher in 2002 than sales by the public sector (\$13.3 billion vs. \$327 million).

The sectors with the highest proportion of firms selling online in 2002 were educational services (21.3%), information and culture (18.8%) and arts, entertainment and recreation (14.1%). Private and public institutions offering educational services have welcomed e-commerce as it is an efficient way for many students to pay their tuition and fees over the Internet, while many firms offering arts, entertainment and recreation services have embraced e-commerce as an effective means of advertising and selling tickets for events.

Data relating to this article were originally released in The Daily on April 2, 2003.

Mark Uhrbach, SIEID, Statistics Canada



Telecommunications service industry improves profits

Despite stagnating revenues, the telecommunication services industry improved its profits during the first half of 2003 by controlling operating costs and reducing capital spending. A strong financial performance of the wireless segment was achieved in spite of a significant slowdown in the expansion of its customer base. The industry continued to slash its capital expenditures. In the first six months of 2003, these expenditures amounted to \$1.9 billion, down from \$2.8 billion for the same period in 2002.

Profits improving of \$2.6 billion

Despite stagnating revenues, the telecommunication services industry improved its profits during the first half of 2003 by containing operating costs and reducing capital spending. The industry recorded 2.6 billion in profits before interest and taxes between January and June 2003, up a robust 19.4% from the same period of 2002 (Chart 1).

Profits before interest and taxes represented 15.9% of revenues for the first six months of 2003, compared with 13.5% in the same period of 2002. Both the wireline and wireless segments of the industry showed improved profit margins.

The industry's revenues rose a modest 1.0% to \$16.1 billion, largely the result of increases in the wireless segment. Revenues for the wireless segment jumped 12.9% in the first half of 2003, compared with a 2.3% drop for the wireline segment.

The decline in wireline revenues continued a downward trend that started in the first quarter of 2002.

Strong financial performance

The strong financial performance of the wireless segment was achieved in spite of a significant slowdown in the expansion of its customer base. The number of subscribers to wireless services

was up 9.7% at the end of the first quarter and 9.8% at the end of the second, both compared with the same period of 2002.

By comparison, the year-over-year increases in the number of subscribers to wireless services jumped 17.5% at the end of the second quarter of 2002, and 23.5% at the end of the second quarter of 2001.

Still investing although slashing capital expenditures

The industry continued to slash its capital expenditures. In the first six months of 2003, these expenditures amounted to \$1.9 billion, down from \$2.8 billion for the same period in 2002, and \$4.1 billion in the first half of 2001. Both segments of the industry made cutbacks, but they were most severe in the wireless sector.

The \$459 million spent to upgrade the wireless network in the first six months of 2003 represented about one-half the amount spent in the first six months of 2002, around \$863 million. It was also less than one-third of the amount spent in the first six months of 2001, about \$1.6 billion.

More detailed information is available in Quarterly telecommunications statistics, Vol. 27, no. 3 (56-002-XIE).

Cimeron McDonald, SIEID, Statistics Canada.



Cable and satellite television, 2002

From the early 50s to the mid-90s, cable companies were the only game in town offering multi-channel video services, and these services represented much of their revenues. The penetration of cable services grew steadily over the period and peaked in the early 90s. The introduction of competition from wireless operators has given new life to the industry. Its clientele has expanded by more than 20.0% between 1997 and 2002. Wireless operators, which had virtually no customers in 1997, have captured a substantial share of the multi-channel video market. Cable operators have diversified and now play a major role in the Internet access market. Digital technology is gradually displacing analogue.

Dish or cable?

The multi-channel video market is growing, and the fight for a bigger piece of the pie is fierce. Wireless operators have done relatively well on this battleground. The number of subscribers of satellite and MDS operators surpassed two million in 2002, and their market share reached the 20% milestone. By comparison, it took cable operators more than 20 years to attract two million subscribers.

The 25.1% increase in the number of subscribers to satellite and MDS television from August 2001 to August 2002, although very impressive, is a significant slowdown in growth compared to previous years (66.4% in 2001 and 74.4% in 2000). The pattern of growth in the penetration of this technology is not unlike that observed in the past for different types of consumer information technologies. That pattern is characterized by very fast and accelerating growth when it is first made available and by decelerating growth in the years that follow.

Cable operators adapting to a changing environment

Some of the gains of wireless operators translated into losses for cable operators. Their challenge was to retain as many subscribers as possible and generate more revenue per subscriber. This meant upgrading the capacity of their distribution network to enable the provision of new services, most importantly high speed Internet and digital video. At the end of August 2002, these upgrades were well underway. Close to 90% of homes with access to cable could subscribe to cable modem and/or digital cable services.

Cable operators have indeed lost subscribers for three consecutive years beginning in 2000. The decline in subscriptions has accelerated every year since then to reach 3.1% in 2002. This has been most severe for operators in small and medium-sized communities where it declined by 5.6% in 2002 and 4.8% in 2001. Despite the loss of subscribers, the revenues of cable operators have increased steadily by more than 7.0% in each year from 1999 to 2002 and their revenue per subscriber at a rate exceeding 8.5%. The systems offering high speed Internet and digital cable sustained the relatively robust performance of this segment of the

industry. In 2002, revenues per subscriber for systems that offered both these services were 32.8% higher than those of systems that did not offer these services or offered only one of the two.

The introduction of high speed Internet by cable was a significant change in the business model of this segment of the industry. This offering has been a key contributor to the industry's revenues and profits. In 2002, revenues from high speed Internet represented 19.2% of the revenues of cable systems providing the service, and for some establishments, that proportion exceeded 30.0%. Only two years earlier, Internet access represented a mere 9.2% of the revenues of operators providing the service.

A shift to digital technology

The entry of satellite and MDS operators into the multi-channel video market not only expanded consumer choice, it also is at the origin of a shift towards digital technology.

At the end of August 2002, more than one third of multi-channel video services customers subscribed to digital wireless or digital cable services. Of these 3.2 million subscribers to digital services, 2.0 million were customers of wireless operators and 1.2 million customers of cable operators.

Digital satellite service is available to almost every home in the country and the footprint of cable digital service is expanding rapidly. In 2002, digital cable was available to nearly 90.0% of homes with access to cable (cable homes). This service was available to virtually all cable homes within large communities, and in smaller communities the technology was available to three quarters of cable homes.

Data in this article were originally published in the service bulletin Broadcasting and Telecommunications - Cable, Satellite and Multipoint Distribution Systems, 2002, catalogue 56-001-XIE, Volume 33, no. 3, released on October 28, 2003.

Daniel April, SIEID, Statistics Canada



New economy indicators

In this issue, we have compiled some of the most important statistics on the new economy. The indicators will be updated, as required, in subsequent issues. For further information on concepts and definitions, please contact the editor.

	Units	1998	1999	2000	2001	2002	2003
General economy and population¹							
GDP	\$ millions	914,973	982,441	1,075,566	1,107,459	1,154,949	..
GDP implicit price index	1997=100	100	101.3	105.4	106.4	107.5	..
Population	thousands	30,157	30,404	30,689	31,021	31,362	31,630
Gross domestic expenditures on R&D (GERD)²							
"Real" GERD	\$ millions 1997	16,142	17,405	19,316	20,786	20,190	..
GERD/GDP ratio	ratio	1.76	1.79	1.89	2.00	1.88	..
"Real" GERD/capita	\$ 1997	535.27	572.45	629.41	670.05	643.77	..
GERD funding by sector							
Federal government	% of GERD	17.6	18.2	17.5	18.1	19.5	19.5
Provincial governments	% of GERD	4.0	4.4	4.3	4.9	5.4	5.6
Business enterprise	% of GERD	45.7	44.9	44.1	48.2	45.3	44.3
Higher education	% of GERD	14.5	15.0	14.2	13.5	15.1	16.0
Private non-profit	% of GERD	2.3	2.2	2.2	2.4	2.7	2.9
Foreign	% of GERD	15.9	15.3	17.7	12.9	12.0	11.7
GERD performance by sector							
Federal government	% of GERD	10.8	10.5	10.2	9.5	10.3	9.7
Provincial governments	% of GERD	1.3	1.3	1.2	1.4	1.5	1.5
Business enterprise	% of GERD	60.2	59.0	59.8	59.6	55.2	53.7
Higher education	% of GERD	27.2	28.8	28.5	29.3	32.8	34.9
Private non-profit	% of GERD	0.5	0.4	0.3	0.2	0.2	0.2
Federal performance as a % of federal funding	% of federal	61.6	57.8	58.4	52.6	52.5	49.8
"Real" federal performance of R&D	\$ millions 1997	1,743	1,859	2,080	2,103	2,224	2,174
Information and communications technologies (ICT)							
ICT sector contribution to GDP - basic prices³							
ICT, manufacturing	\$ millions	9,720	13,168	18,062	12,788	10,608	..
% of total ICT	% of total ICT	25.8	27.7	31.2	22.3	18.1	..
ICT, services	\$ millions	28,020	34,340	39,870	44,457	48,063	..
% of total ICT	% of total ICT	74.3	72.3	68.9	77.7	81.9	..
Total ICT	\$ millions	37,734	47,464	57,858	57,222	58,670	..
Total economy ⁴	\$ millions	848,414	892,870	933,713	947,039	977,322	..
ICT % of total economy	%	4.4	5.3	6.2	6.0	6.0	..
Total business sector	\$ millions	710,188	752,197	791,306	801,870	828,842	..
ICT % of business sector	%	5.3	6.3	7.3	7.1	7.1	..
ICT adoption rates (private sector)							
Personal Computer	% of enterprises	..	81.9	81.4	83.9	85.5	..
E-Mail	% of enterprises	..	52.6	60.4	66.0	71.2	..
Internet	% of enterprises	..	52.8	63.4	70.8	75.7	..
Have a website	% of enterprises	..	21.7	25.7	28.6	31.5	..
Use the Internet to purchase goods or services	% of enterprises	..	13.8	18.2	22.4	31.7	..
Use the Internet to sell goods or services	% of enterprises	..	10.1	6.4	6.7	7.5	..
Value of sales over the Internet	\$ millions	..	4,180	7,246	10,389	13,339	..

¹ Source: Statistics Canada, 2003, *Canadian Economic Observer*, Cat. no. 11-010-XIB, February 2004, Vol.17 no. 02, Ottawa, Canada.

² Source: Statistics Canada, 2003, *Science Statistics*, Cat. no. 88-001-XIB, various issues, Ottawa, Canada.

³ Source: Statistics Canada, 2002, *Beyond the information highway: networked Canada (Information and communications technologies (ICT))*, Cat. no. 56-504-XIE, Ottawa, Canada.

⁴ The "total economy" is in chained-Fisher methods of deflation and therefore does not match GDP.

	Units	1998	1999	2000	2001	2002	2003
Information and communications technologies (ICT) continued							
ICT adoption rates (public sector)							
Personal Computer	% of enterprises	..	100.0	100.0	100.0	99.9	..
e-mail	% of enterprises	..	96.6	99.0	99.7	99.6	..
Internet	% of enterprises	..	95.4	99.2	99.7	99.6	..
Have a Web site	% of enterprises	..	69.2	72.6	86.2	87.9	..
Use the Internet to purchase goods or services	% of enterprises	..	44.2	49.1	54.5	65.2	..
Use the Internet to sell goods or services	% of enterprises	..	14.5	8.6	12.8	14.2	..
Value of sales over the Internet	\$ millions current	..	244.6	11.5	354.8	327.2	..
Teledensity indicators							
Wired access (Voice Grade Equivalent - VGE)	per 100 inhabitants	63.8	64.9	66.1	65.2	63.4	..
Wireless access (VGE)	per 100 inhabitants	18.5	23.7	29.4	34.8	37.6	..
Total public switched telephone network (PSTN) (VGE)	per 100 inhabitants	82.3	88.6	95.5	100.0	101.0	..
Homes with access to cable	thousands	10,564.6	10,725.2	10,896.1	11,107.4	..	..
Homes with access to Internet by cable	thousands	..	..	7,609.7	9,391.4	..	..
Access indicators							
Total wired access lines (VGE)	thousands	19,293.7	19,806.2	20,347.0	20,335.9	19,962.1	..
Residential access lines (VGE)	thousands	12,601.5	12,743.9	12,922.0	12,852.3	12,755.8	..
Business access lines (VGE)	thousands	6,692.2	7,062.4	7,425.0	7,483.6	7,206.3	..
Analogue mobile subscribers	thousands	1,406.4	2,592.0	4,444.0	6,950.6	8,943.6	..
Digital mobile subscribers	thousands	3,939.0	4,318.3	4,282.6	3,911.0	2,905.4	..
Digital cable television subscribers	thousands	..	..	390.4	811.7	..	..
Satellite and MDS subscribers	thousands	..	..	967.5	1,609.4	..	..
High speed Internet by cable subscribers	thousands	..	..	786.3	1,387.8	..	..
Network investment indicators ⁵ —Capital expenditures							
Wireline public telecommunication networks	\$ millions	4,629.1	4,258.7	4,989.9	5,078.7	3,979.5	..
Wireless public telecommunication networks	\$ millions	1,462.6	1,374.1	2,005.7	2,642.4	1,718.3	..
Cable networks	\$ millions	773.2	1,110.8	1,523.9	2,124.6	..	..
Satellite and MDS networks	\$ millions	30.6	194.1	158.1	521.2	..	..
Characteristics of biotechnology innovative firms⁶							
Number of firms	number	..	358	..	375	..	..
Total biotechnology employees	number	..	7,748	..	11,897	..	..
Total biotechnology revenues	\$ millions	..	1,948	..	3,569	..	..
Expenditures on biotechnology R&D	\$ millions	..	827	..	1,337	..	..
Export biotechnology revenues	\$ millions	..	718	..	763	..	..
Import biotechnology expenses	\$ millions	..	234	..	433	..	..
Amount of capital raised	\$ millions	..	2,147	..	980	..	..
Number of firms that were successful in raising capital	number	..	138	..	134	..	..
Number of existing patents	number	..	3,705	..	4,661	..	..
Number of pending patents	number	..	4,259	..	5,921	..	..
Number of products on the market	number	..	6,597	..	9,661	..	..
Number of products/processes in pre-market stages	number	..	10,989	..	8,359	..	..
Intellectual property commercialization⁷							
Federal government							
New patents received	number	130	89	..	110	..	..
Royalties on licenses	\$ thousands	6,950	11,994	..	16,467	..	..
Universities							
New patents received	number	143	325	..	339	..	..
Royalties on licenses	\$ thousands	15,600	18,900	..	44,397	..	..

⁵ Figures for 2001 and 2002 are based on Q4 data from the service bulletin *Quarterly Telecommunications Statistics*, Cat. no. 56-001-XIE.

⁶ Source: Statistics Canada, 2003, *Features of Canadian biotech innovative firms: results from the Biotechnology Use and Development Survey – 2001*, Science, Innovation and Electronic Information Division Working Paper Series, Cat. no. 88F0006XIE2003005, Ottawa, Canada.

⁷ Sources: Statistics Canada, Federal Science Expenditures and Personnel Survey, and Survey of Intellectual Property Commercialization in the Higher Education Sector (various years).

What's new?

Recent and upcoming events in connectedness and innovation analysis.

Connectedness

A new compendium publication, *Canada's Journey to an Information Society*, was released on December 9, 2003. Produced under Statistics Canada's Connectedness program, the publication pulls together a variety of data and analyses from different sources within Statistics Canada to paint a thorough and up-to-date picture of Information Society developments in Canada. It traces Canada's economic and societal transformation, highlights the evolution of the ICT sector and the recent performance of its industries, and includes a collection of thematic studies. Canada's international involvement in the Information Society is also examined through invited contributions from Industry Canada and the International Development Research Centre.

Canada's journey to an information society ([56-508-XIE](http://www.statcan.ca/english/freepub/56-508-XIE/free.htm) <http://www.statcan.ca/english/freepub/56-508-XIE/free.htm>, free) is now available on Statistics Canada's website. From www.statcan.ca, click on *Our products and services* page, under *Browse our Internet publications* choose *Free*, then *Communications*.

Telecommunications

Annual survey of telecommunications service providers

The service bulletin *Broadcasting and Telecommunications—Telecommunications Industries—2001*, catalogue 56-001 XIE, volume 33, no. 4 was released in December 2003.

Quarterly survey of telecommunications service providers

The first and second quarter editions of Service Bulletin—*Quarterly Telecommunications Statistics*, catalogue 56-002 XIE, Vol. 27, No. 1 and No. 2 were released in November 2003.

The third quarter edition was released on January 19, 2004.

Broadcasting

The service bulletin *Broadcasting and Telecommunications - Cable, Satellite and Multipoint Distribution Systems, 2002*, Cat. No. 56-001-XIE, Volume 33, no. 3 was released in October 2003.

The service bulletin *Broadcasting and Telecommunications - Telecommunications Industries, 2001*, Cat. No. 56-001-XIE, Volume 33, no. 4 was released in December 2003.

Household Internet use

E-commerce: Household shopping on the Internet, 2002 was released in December 2003.

Business e-commerce

Survey of electronic commerce and technology

The 2003 *Survey of Electronic Commerce and Technology* was mailed out to survey participants in November 2003.

Science and innovation

S&T activities

Industrial research and development 1999 to 2003

The annual publication, *Industrial Research and Development, 2003 Intentions (with 2002 preliminary estimates and 2001 actual expenditures)* 88-202-XIE was released in December 2003.

The working paper *Bioproducts development by Canadian biotechnology firms: Findings from the 2001 biotechnology use and development survey 2001*, was released in December 2003.

The working paper, *Estimates of research and development personnel in Canada, 1979 to 2000*, was released in November 2003.

The working paper, *Estimates of total expenditures on research and development in the health field in Canada, 1988 to 2002p*, was released in October 2003.

The service bulletin *Research and development (R&D) personnel in Canada, 1991 to 2000* was released in October 2003. Federal and provincial S&T

Federal science expenditures

The service bulletin *Federal government expenditures on scientific activities, 2003-2004^p* was released in December 2003.

Higher Education Sector R&D

The working paper *Survey of intellectual property commercialization in the higher education sector, 2001* was released in October 2003.

Provincial research organizations

No updates to report.

Human resources and intellectual property

Federal intellectual property management

Federal science expenditures and personnel, intellectual property management annex

The 2002-03 survey is in the field.

The higher education sector

Intellectual property commercialization in the higher education sector

Consultations regarding the content of the 2003 survey are underway.

Innovation

Innovation in manufacturing

Analysis of the micro-data from the *Survey of Innovation 1999* by internal and external researchers is on-going.

Innovation in services

Collection ended in December for the 2003 *Survey of Innovation in Selected Service Sector Industries*. Data will be released in the *Daily* March 31, 2004.

Biotechnology

The report *Bioproducts Development by Canadian Biotechnology Firms: Findings from the 2001 Biotechnology Use and Development Survey* was released in December 2003.



Book notices

Four new books we recommend very highly.

Understanding Innovation in Canadian industry (Fred Gault, editor)

Promoting innovation is a preoccupation of most industrialized countries and Canada, with its Innovation Strategy, released in February 2002, is no exception. In the context of such a strategy, understanding the activity of innovation, and the links between actors in the innovation system, contribute to the policy debate.

Large firms are more likely to produce a 'world-first' innovation, to have R&D units, to enter into collaborations, especially local ones, and to appropriate intellectual property from government laboratories. This contrasts with smaller firms that are more likely to produce innovations that are new to the firm, rather than world-first, and to draw upon more informal sources of information, such as trade journals or conferences, as they lack the absorptive capacity needed to capture intellectual property. These findings have implications for commercialization policy and for technical assistance programs.

As well as providing findings on innovation, and the system in which it takes place, the book is an introduction to how large surveys are designed, carried out, and analyzed as part of the policy process. All of the material needed to follow the process is either in the book or freely available on the Statistics Canada web site.

The analysis, leading to the findings, uses a variety of econometric methods, as well as descriptive statistics. A chapter reviews the methods used and comments on the balance between econometric techniques and descriptive methods. It allows the reader to benefit more from the presentation of the analytical methods in the rest of the book, and to develop a critical appreciation of technique and of interferences gained.

Empirical findings are linked to policy throughout and the book ends with proposals for statistical measurement, analysis, and policy. While the book is focused on Canada, the findings and recommendations apply to any industrial economy.

Contributors

- Nabil Amara, University of Laval;
- Frances Anderson, Statistics Canada;
- Anthony Arundel, MERIT (Maastricht Economic Research Institute on Innovation and Technology), University of Maastricht;
- Peter Boyd, Industry Canada;
- Vanessa Chang, Industry Canada;
- Brian P. Cozzarin, University of Waterloo;
- Fred Gault, Statistics Canada;
- Daood Hamdani, Statistics Canada;
- Petr Hanel, University of Sherbrooke and CIRST (Centre interuniversitaire de recherche sur la science et la technologie);
- Jeanne Inch, Canadian Heritage;
- Réjean Landry, University of Laval and the ISRN (Innovation Systems Research Network);
- Can D. Le, Industry Canada;
- Pierre Mohnen, MERIT, University of Maastricht, CIRANO (Centre interuniversitaire de recherche en analyse des organisations) and UQAM (University of Québec at Montreal);
- Brian Nemes, Statistics Canada;
- Susan Schaan, Statistics Canada;
- Andrew Sharpe, Centre for the Study of Living Standards (CSLS);
- Jianmin Tang, Industry Canada; and
- Pierre Therrien, Industry Canada.

The book is edited by Fred Gault and published by McGill-Queen's University Press: ISBN 1-55339-030-X.

Monitoring the Digital Divide...and beyond (George Sciadas, editor)

Recently released from Orbicom, *Monitoring the Digital Divide...and beyond* offers a global set of indicators describing, measuring and monitoring the "digital divide".

The publication sets high standards in international benchmarking and places particular emphasis on developing countries. Its unique features include:

- a cohesive conceptual framework, which goes beyond connectivity measures and logically incorporates skills, as well as offering rich analytical linkages,
- explicit measurements both across countries at a given point in time and within countries over time in such a way that comparisons are not reduced to changing rankings from year to year,
- policy relevant results on a component-by-component basis,
- immediate benchmarking against the average of all countries and the planet as a whole, and
- use of existing and reliable data sets with a sound and transparent statistical methodology

The empirical application of the model includes a large number of countries with measurements of networks offered for 192 countries; of skills and overall infodensity for 153 countries; of info-use for 143 countries; and overall infostate for 139 countries. The results, extending over 1996-2001, are based on 21 variables, reliable, tested and available to all.

The book is a contribution to the international community in the context of the World Summit on the Information Society (WSIS), recently held in Geneva in December 2003. The scientific director and editor is George Sciadras from SIEID, Statistics Canada.

The publication was released by Orbicom, in collaboration with CIDA, infoDev (World Bank) and UNESCO. Orbicom is the network of UNESCO chairs in the field of communications—including 28 chairs and over 250 associate members in 71 countries.

Measuring knowledge management in the business sector: First steps (Dominique Foray and Fred Gault, editors)

Knowledge management involves any activity related to the capture, use and sharing of knowledge by an organization. Evidence shows that these practices are being used more and more frequently and that their impact on innovation and other aspects of corporate performance is far from negligible.

Today, there is recognition of the need to understand and to measure the activity of knowledge management so that organizations can be more efficient and governments can develop policies to promote these benefits.

This book offers a synthetic view of the results of the first systematic international survey on knowledge management carried

out by national statistical offices in Canada, Denmark, France and Germany.

The book was edited by Dominique Foray (OECD) and Fred Gault (Statistics Canada) and was published by the Organisation for Economic Co-operation and Development (OECD). OECD Reference Number (96 2003 02 1 P 1). Co-published with Statistics Canada. ISBN 92-64-10026-1 - No. 53127 2003.

Statistics Canada Quality Guidelines: Fourth Edition - October 2003

Statistics Canada places great importance on the management of data quality to ensure that its statistical outputs satisfy user needs.

In the domain of survey methodology there is no overall professional code of practice, or set of standards, that defines good practice for all situations. Survey methodology is rather a collection of practices, backed by a combination of theory and empirical evaluation, among which practitioners have to make sensible choices in the context of particular applications. These choices must attempt to balance the often competing objectives of relevance, accuracy, timeliness, cost and reporting burden.

The first edition of *Quality Guidelines* appeared in 1985. A subsequent edition with minor revisions was published in 1987. Significant developments in survey methodology since that time, for example in the integration of computer and technology and electronic communications into data collection and processing, have led to changes in the flow of survey operations as well as to new approaches to the storage and dissemination of data. These advances in survey methodology motivated the issuing of a third version of the Guidelines in 1998. The present document has been significantly updated to reflect further advances in survey methodology over the past five years.

The Quality Guidelines document consolidates a set of experiences and conclusions that, individually and in their particular contexts, have been judged to represent "good practice". They will not all apply equally to every data acquisition process. Their applicability and importance will have to be carefully considered in light of the particular requirements and constraints of individual programs. The author therefore advises that the document must therefore be used with considerable professional care and judgment.

It is accessible on the Internet at: <http://www.statcan.ca/english/freepub/12-539-XIE/free.htm> (or [Definitions, data sources and methods](#) → [Quality guidelines](#)).

